

Video and Broadcast Components

This chapter presents the PC 99 requirements and recommendations for video playback, video input and capture devices, and technologies for broadcast-enabled computers.

Specific requirements related to video and broadcast components are defined in the following chapters:

- Requirements related to graphics adapters and television output capabilities are defined in the “Graphics Adapters” chapter in Part 4 of this guide.
- Requirements related to displays are defined in the “Monitors” chapter in Part 4 of this guide.
- Requirements related to digital cameras and other digital image input devices are defined in the “Scanners and Digital Cameras” chapter in Part 4 of this guide.

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Introduction to Video and Broadcast Components

Soon, video and broadcast television will become integral elements of PC usage, for Consumer, Office, and Entertainment PCs. For PC 99, important design issues include:

- Increased quality of video capture and playback. This includes an absence of banding related to poor scaling methods.
- Introduction of Device Bay as a way of implementing television receiver modules. This is in addition to the use of PCI adapters and external receiver boxes which are also acceptable implementations.
- Support for receiving digital TV broadcasts.
- Increased use of multiple screens and their associated display controllers. This allows a PC in the den running a word processing application to simultaneously supply a TV in the family room with a DVD movie or TV content.
- Gradual separation of “receiver” functions from “display” functions. The two will be linked by software running on the host processor. This allows different MPEG elementary streams such as video, audio and data to be sent to the appropriate subsystems within the PC. It also prepares the way for the longer range goal of a video home network
- Low-latency video delivery, displaying video from both internal and external video devices.
- Easy connectivity and installation for the end user.

This requires a reduction in complexity of installation by decreasing the number of components such as power supplies and add-on adapters and decreasing the number of user responses required to install a device.

DirectShow for Video Support. No functionality will be added to Video for Windows (VfW) in any future version of the Windows and Windows NT operating systems. Support for video playback is provided only under Microsoft DirectShow.

New technologies that will make PCs more compelling by integrating them with television are also becoming available. These technologies consist of broadcast components that allow PCs to receive television programming, data services, and new forms of entertainment that blend the two, plus user-interface elements appropriate for use on large-screen display devices such as a progressively scanned display or a television monitor. The new technologies will enable new applications, such as the following:

- By combining the PC, the television, and the Internet, content companies can create new types of programming.

- By using broadcast technology to push multimedia-rich Internet content to consumers, broadcast networks can deliver and store data locally on the PC, reducing the Internet bandwidth bottleneck while improving the consumer's overall experience.
- By delivering a new set of secure, billable, and scaleable data services—such as subscription services for software, electronic news, and entertainment delivery—broadcast services will encourage the creation of new business models.

These technologies, which are built into the Windows 98 and Windows NT 5.0 operating systems, are based on industry standards such as MPEG-2, Win32, ActiveX, and DirectX. These technologies are also built on current and emerging standards for broadcast networks and Internet protocols, and they enable IP Multicast as a point-to-many networking standard for network traffic. Broadcast network capabilities provide a transmission infrastructure that can support automatic software and file updates as well as other services.

Consumer Electronics and PCs. The convergence of consumer electronics and personal computing offers new revenue opportunities for participating manufacturers. It also offers the chance for companies from different industries to collaborate on production of new products and services. Companies developing technologies and services that use these components span every industry involved in technology convergence. The related requirements for the elements of broadcast-enabled television are defined in this chapter.

These guidelines are designed to make sure that PCs and related computer devices will be able to do everything the television, VCR, set-top box, and hi-fi system can do. These guidelines are defined in such a way as to add features while introducing PCs to these traditional areas without taking away any television features. In particular, this means that the PC must meet or exceed the video and audio quality of traditional consumer appliances.

System Requirements for Video and Broadcast Components

This section summarizes the PC 99 requirements for video and broadcast components.

1. System meets PC 99 requirements for playback of MPEG-2 video from DVD-Video

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Required with DVD-Video</i>	<i>Required with DVD-Video</i>	<i>Required</i>
Under Windows and Windows NT, operating-system playback support for MPEG-1 is provided through DirectShow. This requirement refers to built-in system support for DVD-Video playback or any other Main Profile at Main Level (MP@ML) MPEG-2 source, whether decoding is provided as a hardware decoder, a software decoder, or a combination of the two.		

Related requirements are defined in the “MPEG-2 Playback Requirements” and “DVD-Video Playback Requirements” sections later in this chapter.

2. System meets PC 99 requirements for playback of MPEG-2 video from digital television broadcasts

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

If the PC 99 system includes support for decoding and viewing video from digital television broadcasts, whether provided as a hardware decoder, a software decoder, or a combination of the two, the system must deliver video quality that meets PC 99 MPEG-2 playback requirements.

See the related requirements defined in the “MPEG-2 Playback Requirements” section later in this chapter.

3. System supports PC 99 analog video input and capture capabilities

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

Analog video capture capability is recommended for Consumer PC 99 and Office PC 99 and is required for Entertainment PC 99.

If video capture capability is implemented in a PC 99 system, it must meet the requirements defined in the “Video Input and Capture Requirements” section later in this chapter.

For PC 99, all video input sources and capture devices must implement driver support as defined for WDM Stream class in the Windows NT 5.0 DDK.

4. System includes analog television tuner

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

An analog television tuner is required for any Entertainment PC 99 system. This can be implemented as a cable tuner or broadcast tuner.

For information about the supporting tuner device, see the “Television Tuner and VBI Capture Requirements” section later in this chapter.

5. System includes digital satellite receiver module

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>

If this capability is included in a PC 99 system, the implementation must include a satellite tuner, demodulator, smart card, de-scrambler, and drivers that meet PC 99 requirements as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

6. System includes digital cable receiver module

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
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<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>
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In North America, the television programming distribution method with the highest market share is cable TV, which is in the process of converting from analog to digital. If a digital cable receiver module is included in a PC 99 system, the implementation must include a tuner, demodulator, smart card, de-scrambler, and drivers that meet PC 99 requirements as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

The implementation should be in accordance with the OpenCable initiative and the de facto specifications established by cable companies.

7. System includes ATSC DTV support

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
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<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>
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ATSC DTV offers the richness of high-resolution video and high-fidelity audio joined with the interactive content of the PC and the Internet.

Television broadcasters will start ATSC DTV broadcasting in North America before the PC 99 time frame. PC monitors represent the largest installed base of display devices capable of displaying high-resolution video, and it is essential that the rest of the PC architecture be capable of supporting display of high quality video.

The system should include a receiver module with support for analog TV in addition to an 8-VSB tuner/demodulator required for terrestrial ATSC DTV reception.

It is a requirement that receivers must support at least the ATSC formats of 480p60 and 720p24, otherwise known as HD0. Higher ATSC formats are allowed.

Specifications and technical information are available at <http://www.atsc.org>. Support for ATSC DTV includes meeting hardware and software requirements for a tuner/demodulator, MPEG-2 decode capabilities, and graphics adapters as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

8. System includes DVB cable, satellite, or terrestrial receiver module

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
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<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>
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If this capability is included in a PC 99 system, the implementation must include a cable, satellite or terrestrial tuner, demodulator, an optional smart card and/or DVB Common Interface, de-scrambler, de-multiplexer, and drivers that

meet PC 99 requirements as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

Specifications and technical information are available at <http://www.dvb.org>. Support for DVB digital TV includes meeting hardware and software requirements for a tuner/demodulator, MPEG-2 decode capabilities, and graphics adapters as defined in the “Digital Broadcast Television Requirements” section later in this chapter.

9. System includes support for multiple digital television delivery methods

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Recommended</i>

Digital TV services will be delivered by a multitude of different methods. All PCs, particularly Entertainment PCs, should have a good modularity scheme to allow the user to decide which delivery methods to be used. This capability may be provided by external connectivity using the IEEE 1394 bus or by internal connectivity using Device Bay or other mechanical form-factors.

10. MPEG sources such as DVD or a receiver module support bus mastering

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Required</i>	<i>Required</i>	<i>Required</i>

The bus mastering requirement applies for the DVD drive and any receiver of broadcast MPEG streams. This is required to minimize the CPU bandwidth needed to move data from an input source, such as a DVD drive or digital television receiver module, to an MPEG decoder.

Specifically, this means that each stream (with a minimum of eight streams) must have a set of logical buffers (digital broadcast satellite and DVD require a minimum of 16 buffers) composed of physical data segments (with a minimum of 16 + 1 of up to 64K for each buffer). Each logical buffer can begin or end on any byte position in physical memory. Thus, the first and last physical data segment can be smaller than a physical memory page (~~4K~~), but the intervening segments will be contiguous multiples of the ~~4K~~ physical-memory page size.

As defined in the “Storage and Related Components” chapter in Part 4 of this guide, DVD drives and other IDE storage controllers and devices must support DMA.

11. Video input, capture, and broadcast device support is based on DirectX foundation class and WDM Stream class

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Required</i>	<i>Required</i>	<i>Required</i>

The driver for any video or tuner device must use the DirectX foundation class to control all video data. The WDM Stream class must be used to support any data streaming. For information, see the DirectX 5.0 DDK and the Windows NT 5.0

DDK. See also the PC 99 requirements defined in the “Device Drivers and Installation for Video and Broadcast Components” section later in this chapter.

12. MPEG-2 decoder for high-definition video uses a video port for video data, if implemented in hardware and if separate from the graphics adapter

Consumer PC 99

Office PC 99

Entertainment PC 99

Required

Required

Required

It is expected that those implementations that use a hardware MPEG-2 decoder will site it on the graphics adapter, because of the electrical problems in feeding digital video at high-definition rates over ribbon cable. When the decoder is implemented on the same graphics adapter, there is no requirement for the internal bus that might be needed to connect the decoder and the graphics controller. Solutions that use software MPEG decoding or a combination of hardware and software decoding are equally valid if they meet the PC 99 video quality requirements.

For any PC 99 system that includes a DTV MPEG-2 hardware decoder that is not sited on the graphics adapter, the decoder must use a video side port for piping video data to the graphics adapter. The PCI bus must not be used for uncompressed video data at high-definition rates (instantaneous data rates above 27 MB/sec). Systems with MPEG-2 decoders that use the video port of the graphics adapter must provide a method to disable the decoder output. A separate external multiplexer (MUX) meets this requirement.

The fundamental requirement is that video streams on the PCI bus must not exceed a peak rate of 27 MB/sec. This is designed to allow a single standard definition uncompressed video stream to be bus mastered across the bus. It can also be used for multiple lower definition streams, provided that the total peak rate does not exceed 27 MB/sec.

The host software must be responsible for selecting the required MPEG video streams and feeding them to the MPEG decoder. DirectShow will include this capability, which is fundamental to the architecture for digital video on PCs. It is not acceptable to implement a “round the side” hardware path from the receiver to the MPEG decoder.

For more information, see the “Applications provided with device meet Win32 requirements” requirement for DirectShow later in this chapter. In future versions of these guidelines, requirements will stress the philosophy that digital receiver functions should be kept separate from the display functions. Systems with multiple video sources that use the video port on the graphics adapter, including television tuner and capture on the system board or multiple Zoomed Video (ZV) ports, should offer a way to control the flow of video from multiple video sources into a single video port.

Mobile PC Note

For mobile PCs, the ZV standard is available for CardBus peripherals. ZV support must be implemented as defined in *PC Card Standard Guidelines, Volume 10* (PC Card standard). For more information, see the “PC Card” chapter in Part 3 of this guide.

For video sources that have the ability to open circuit their output buffers, there should be a method for arbitrating among multiple devices to avoid bus contentions. At system power up, all devices must come up with their output buffers disabled.

In addition, it is recommended to implement a straightforward method for the software to command the device to disable its output buffers. In the future, this capability might be used by the operating system to avoid bus conflicts in the case of a soft restart. Driver support for any video port implementation must be based on DirectDraw Video Port Extensions (VPE) as defined in the DirectX 5.0 DDK.

For more information, see the related “Video port meets PC 99 specifications” requirement in the “Graphics Adapters” chapter in Part 4 of this guide. See also the white paper on DirectDraw VPE and kernel-mode video transport at <http://www.microsoft.com/hwdev/devdes/>.

13. PCI-based sources of uncompressed standard-definition digital video must support bus mastering with scatter/gather DMA

Required

In the PC 99 time frame, some NTSC/PAL/SECAM decoders and some MPML MPEG decoders will be implemented on PCI adapters and some of the designs will want to send uncompressed video over the PCI bus. This practice of sending raw video over the PCI bus needs to be done with great care. There is a real danger of causing dropped video frames and causing congestion on the bus so that other functions cannot use the bus when needed.

PCI-based hardware for video display applications must support byte-aligned, multi-segment bus master DMA transfers. Devices that are sources (or sinks) for data must be capable of transferring data to or from multiple, non-contiguous host memory buffers that are byte-aligned and odd sized. The device must support such byte-aligned, odd-sized, non-contiguous buffers using host memory-based buffer transfer descriptors. Bus mastering operations must also be able to operate on non-aligned, odd-length data.

14. All MPEG-2 decoders can accept an MPEG-2 elementary stream

Required

DirectShow provides the selection and de-multiplexing of MPEG transport streams. Stream filtering in hardware can be used to aid this process. DirectShow feeds the appropriate video stream such as PES to the MPEG decoder. It is essential that the decoder is able to take MPEG in that form.

15. All MPEG transport streams are de-multiplexed by the central host processor

Required

MPEG streams can come from a number of sources, including different PCI receivers, Device Bay receivers, a set-top box, a set-top computer, a network such as the Internet, or a video-conferencing camera, and so on. DirectShow provides support for selecting the required MPEG elementary streams, de-multiplexing them, and feeding them to the appropriate decoder or subsystem. Stream filtering in hardware can be used to aid this process.

In the same way that it sends the video to the video decoder, the host software (comprising DirectShow, NDIS, and other components) also sends the audio to the audio decoder and the data services to the appropriate place. This is fundamental to the architecture for digital television on PCs. On a particular PC, each subsystem could be implemented in software, hardware, or a combination of the two. The operating system needs to be able to manage all the different configurations. It is not acceptable to implement a round-the-side hardware path from the receiver to the MPEG decoder.

The requirement that all digital compressed video streams are routed by way of the central host software will also make it easier to migrate to a video-capable home network environment, where the receiver functions and display functions will typically be in completely separate boxes. It is also fundamental for such things as automatic program recording, etc.

16. Background tasks do not interfere with MPEG-2 playback

Consumer PC 99

Office PC 99

Entertainment PC 99

Required

Recommended

Required

This requirement applies to background tasks initiated by applications included with the PC. Video performance should be such that non-foreground tasks—such as downloading a web page or using answering-machine software—should occur without disrupting video playback, including DVD and television. When the user runs an application in the foreground that requires significant system resources, such as a game or video answering machine, the system should degrade gracefully.

For Consumer PC 99, this requirement applies only to applications that are started automatically by the pre-configured OEM software, such as programs in the Windows/Start Menu/Programs/Startup folder. This guarantees that the video experience “out of the box” is as good as or better than consumer television and other A/V components.

For Entertainment PC 99, this requirement applies to all applications included with the system, whether run automatically by the OEM software pre-configuration or run only by the user. This is a critical requirement for Entertainment PC 99 systems, whose users will rely on the PC to perform normal day-to-day operations simultaneously with DVD-Video playback and television.

Specific examples of operations that must not interfere with MPEG-2 playback include the following:

- Answering the telephone to receive voice mail or fax. This applies only to telephony software included with the PC, not third-party software installed by the user. Notice that telephone answering must not be automatically disabled during MPEG-2 playback unless explicitly configured by the user.
- Running scheduled communications tasks such as automatic connection using the modem or ISDN to transfer e-mail and faxes, download cached Internet content, and so on.

Note: Programs that make intensive use of system resources or that are designed for interactive foreground operation are excluded from this requirement. This includes games, video and audio playback, speakerphone, and disk utilities such as error checking, defragmentation, and virus protection.

17. All components meet PC 99 general device requirements

Required

This includes the basic requirements for a Plug and Play device ID, automated software-only settings for device configuration, device drivers and Windows-based installation, and icons for external connectors. For more information, see the “Basic PC 99” chapter in Part 2 of this guide.

Note: To ensure proper connection by the user between the VGA monitor, S-Video, and composite cables and connectors, an icon must be added to any external connector using vendor designs or any of the appropriate designs provided in the “Icons” appendix in the References part of this guide.

18. System supports DV decoding and encoding

Consumer PC 99

Office PC 99

Entertainment PC 99

Recommended

Recommended

Recommended

This feature is necessary for displaying video from digital camcorders and for compressing video from other sources. Typically the digital camcorder will supply DV-encoded video to DirectShow. Within DirectShow there is a software DV codec that can provide the necessary functionality. Although this means that hardware DV decoding is not required, it can be used to improve performance or lessen CPU loading.

MPEG-2 Video Playback Requirements

The requirements in this section apply for MPEG-2 decoders. All requirements apply for both software and hardware decoders or any combination of both unless otherwise noted in a specific requirement. The requirements in this section apply for devices that support playback of an MPEG-2 stream from any source, including DVD, digital television receiver modules, hard drives, and so on.

Any PC 99 system that includes the ability to play back MPEG-2 video must meet the requirements listed here to ensure quality playback of MPEG-2 data. A PC with an MPEG-2 playback application and MPEG-2 decoder is an example of a system that must meet these requirements.

The system should have a single MPEG-2 decoder that can fulfill all PC 99 DVD-Video requirements and all PC 99 digital television requirements.

For decoder driver requirements, see the “Device Drivers and Installation for Video and Broadcast Components” section later in this chapter. For related MPEG-2 audio playback requirements, see the “Audio Components” chapter in Part 4 of this guide.

Important: If a hardware MPEG decoder is implemented that decodes higher formats than MP@ML and it is not integrated in the graphics adapter, a video port must also be included as part of the video subsystem, as defined in the “System Requirements for Video and Broadcast Components” section earlier in this chapter. The recommended cabled video side port implementation is VIP.

Mobile PC Note

Reviewers note: Appropriate performance guidelines for mobile PCs that implement video playback will be defined in a future draft of these guidelines.

19. MPEG-2 MP@ML playback meets PC 99 requirements

Consumer PC 99	Office PC 99	Entertainment PC 99
Required with DVD-Video	Required with DVD-Video	Required

All MPEG-2 decoder implementations—whether implemented as hardware, software, or a combination of both—must be capable of the following:

- MPEG-2 MP@ML playback, with no dropped frames.** Playback requirements include full-frame rate decode of MPEG-2 MP@ML input streams, up to and including the following frame sizes and rates:

720 × 480 at 60 fields per second	720 × 480 at 24 frames per second
720 × 576 at 50 fields per second	720 × 576 at 25 frames per second

Decoded frame rate is measured at the graphics frame buffer. The actual rate at which video is displayed (or rendered) is covered in the following requirement for smooth frame delivery in the “MPEG implementations meet PC 99 quality requirements” item later in this section.
- Rates for decoding and displaying data.** This requires MPEG-2 data rates of up to a peak rate of 9.8 Mb/s for Consumer PC 99 and Office PC 99, and a peak rate of 15 Mb/s for Entertainment PC 99. This applies to both hardware and software MPEG decode implementations.

20. MPEG-2 playback for ATSC, DVB, or other digital television systems meets PC 99 requirements

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Recommended</i>	<i>Recommended</i>	<i>Required</i>

All digital TV MPEG-2 decoder implementations—whether implemented as hardware, software, or a combination of both—must support at least the ATSC formats of 480p60 and 720p24, otherwise known as HD0. Higher ATSC formats are allowed.

The formats required for a ATSC DTV receiver are contained in Table 3 of *ATSC Digital Television Standard (A/53)*, available at www.atsc.org. A DVB receiver may be specified as either a SDTV or HDTV device at either 25 Hz or 30 Hz. The video formats required for each device are contained in document ETR 154, available for DVB members at <http://www.dvb.org>. The viewing experience when decoding these formats must meet or exceed that obtainable on consumer digital televisions.

An ATSC DTV receiver is not required to decode and display all video formats in native resolution. The MPEG-2 decoder and graphics adapter may process the video to convert the video to a higher or lower resolution to match the capabilities of the graphics adapter and display subsystem.

21. MPEG-2 video decode implementations meet PC 99 quality requirements

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Required</i>	<i>Required with DVD-Video</i>	<i>Required</i>

The following are required for MPEG decoder implementations, whether they are just MP@ML MPEG decoders or full digital TV MPEG decoders.

- **Smooth frame delivery.** All the video fields and frames from the MPEG source should be decoded—that is, all 60 fields per second from a 480i source and all 60 frames per second from a 480p60 source. Video frames must be displayed within one-half frame of the intended display time. This requirement is satisfied for implementations in which video frames are completely rendered into a DirectDraw surface and flipped using the DirectDraw Flip API or a hardware autoflip within one-half frame of the intended display time.

It is generally accepted in the video broadcast industry that any level of frame slippage or jitter can be noticeable to viewers and will be considered an annoyance compared to the smooth viewing experience provided by standard broadcast television, VCRs, and so on. No frame dropping or repeating is allowed except for the dropping or repeating of a single frame for synchronization purposes—which is not allowed to occur more than once per minute for a stable source. When changing sources, frame dropping can occur more often for the first three minutes after that source is present. This exception allows long-time constant phase-locked loops to acquire the new timing.

- **Synchronized audio and video.** Audio and video must be synchronized to within one and a half video frames. This synchronization must not be allowed to drift out over time.
- **No tearing.** This requires proper video buffering, such as double buffering.
- **Correct display of multiple aspect ratio content.** The material should be displayed according to the aspect ratio information in the MPEG header.
- **Output of all remaining frames at the end of the data sequence.** This requirement ensures output of all remaining frames when the decoder receives one of the following:
 - A sequence_end_code message (which differs from an Ipin::EndOfStream() function call)
 - A time discontinuity
- **Splicing MPEG.** Decoders must properly interpret the Closed_Gop flag by dropping B frames before the first I frame after either a data discontinuity is received or the Broken_Link flag is set.

The Joe Kane Video Essentials disk will be used to assess the quality of the video display.

See the related video and MPEG-2 support requirements for graphics adapters, such as YUV (4:2:0 and 4:2:2) off-screen overlay surface and up/down interpolated scaling, as defined in the “Hardware Acceleration for Video Playback” section in the “Graphics Adapters” chapter in Part 4 of this guide.

22. De-interlacing of standard-definition video meets PC 99 requirements

<i>Consumer PC 99</i>	<i>Office PC 99</i>	<i>Entertainment PC 99</i>
<i>Required with DVD-Video</i>	<i>Required with DVD-Video</i>	<i>Required</i>
Standard-definition video is defined as 480i60(30) or 576i50(25)— alias otherwise known as 525i/60 and 625i/50 if the blanking interval is included. These standard-definition signals must be properly de-interlaced to produce the required progressive output for mixing with graphics and sending to the PC monitor.		

Because the PC monitor is typically capable of displaying high resolution, it is important to extract as much resolution as possible from the standard-definition interlaced signals. The minimum requirement is to use the weave method for film-originated material and the bob method for video-originated material. Combined vertical spatial and temporal interpolation using at least two input fields is highly recommended for an Entertainment PC 99. More information can be found in the white paper at <http://www.microsoft.com/hwdev/desinit/>.

Good quality de-interlacing is also required for video delivered by analog means. It is expected that most PCs will implement a single high-quality decoder and will allocate it to either analog or digital sources.

23. Retail adapters with high-definition hardware MPEG-2 decoders on separate card provide a standard video port connection to the graphics adapter*Required*

PC 99 retail upgrade adapters sold independent of PC systems cannot use PCI for uncompressed video transfer to the graphics subsystem for anything other than standard-definition video. Digital video at higher rates must be transferred using a video port connection to the graphics adapter.

The VESA Video Port committee has standardized VIP as the video side port. Revision 2.x of this specification is expected to be adopted in the PC 99 time frame. It is recommended that high-definition MPEG-2 decoder implemented on a separate adapter on all PC systems and retail add-on adapters comply with this standard.

24. MPEG-2 decoder supports pull-down algorithm*Recommended*

An MPEG-2 software or hardware decoder should be able to detect and behave accordingly when 3:2 pull down (or any other algorithm) is being used to display 24-fps video. The kernel-mode video transport component in DirectDraw 5.0 requires this information from the decoder in order to know when a particular field skipping redundant field algorithm is being used so it knows which fields to skip.

For more information, see the DirectX 5.0 DDK; see also the article on <http://www.microsoft.com/hwdev/devdes/>.

DVD-Video Playback Requirements

In addition to the requirements in the previous section, the following requirements apply for systems that provide DVD-Video playback software and hardware. The goal for DVD and other audio/video (A/V) playback is to ensure that the end-user experience is the same or better than with a stand-alone DVD player.

25. DVD decoder driver correctly handles media types, time discontinuity, and decode-rate adjustment*Required*

This requirement specifies that the vendor-supplied minidrivers for DVD, MPEG-2, and AC-3 decoders have the following capabilities:

- Use the correct media types, including validation of all format block fields on connection and on every IPin::QueryAccept message.
- Query for IMediaSample2 on every received media sample to test for a time discontinuity bit.

It is also acceptable to query on every video/audio frame to reduce CPU overhead.

- Adjust the decode rate in response to IPin::NewSegment() calls for video and subpicture.

For details about APIs, see the DirectShow documentation in the Microsoft Platform SDK.

26. DVD decoder supports subpicture compositing and closed captioning

Required

The system must be capable of displaying subpicture data as well as providing closed-captioning support for all such data stored on the disc. This requires YUV offscreen overlay surface support, as defined in the “Adapter supports MPEG-2 and DVD-Video features” requirement in the “Graphics Adapters” chapter in Part 4 of this guide.

Subpicture streams must be supported as defined in *DVD Specification, Version 1.0*, from Toshiba Corporation.

Note: Alpha blending (or a simulation implemented in the driver) is required for static menus.

27. Subpicture decoder correctly handles subpicture properties and other functions

Required

The minidriver for the subpicture decoder must be able to correctly handle the following:

- Must be able to set the subpicture properties
- Must be able to turn the subpicture compositing on and off
- Must be able to set the highlight rect parameters

For more information, see the Microsoft DirectX 5.1 SDK and the DirectX 5.0 information in the Windows NT 5.0 DDK.

28. System supports seamless DVD-Video 1.0 navigation

Required

This requirement includes menu navigation, video selection, and language and subpicture track selection in support of the user’s ability to navigate DVD-Video discs. Test sources include but are not limited to the following:

- Matsushita Electronics Incorporated (MEI) test disc
- Joe Kane Productions Video Essentials disc
- Microsoft test disc

29. System provides a licensed CSS copyright protection scheme*Required*

The system must provide a licensed content scramble system (CSS) implementation and support for CSS encoded DVD-Video discs to ensure proper protection for content produced in accordance with CSS, including regionalization and analog video protection/analog protection system (APS).

To facilitate the authentication process required by this scheme, software is provided as part of the Windows and Windows NT operating system support for DVD. This allows a DVD-ROM drive to authenticate and transfer keys with a CSS decrypter. Windows and Windows NT operating system software will act as the agent to allow either hardware or software decrypters to be authenticated.

Playback of regionalized movies must be handled in accordance with the CSS requirements and the interfaces as defined in the Mt. Fuji 2.0 specification for Phase II regionalization (RPC II). Version 2.0 of the Mt. Fuji specification will be proposed to the Small Forms Factor committee as SFF 8090 Version 2.0 Revision 1.0. PC 99 implementations should conform to this specification if it is approved in the PC 99 time frame.

For more information about copyright protection requirements, see the “Storage and Related Peripherals” chapter in Part 4 of this guide. For information about CSS or to obtain a CSS license, contact MEI (see <http://www.mei.co.jp>), or contact the CSS licensing entity when it is established.

Video Input and Capture Requirements

This section summarizes requirements based on new capabilities that support video capture in the Windows 98 and Windows NT 5.0 operating systems. Analog video capture is required for Entertainment PC 99 but not for other PC 99 system types. If this feature is implemented, the requirements in this section must be met.

For requirements related to digital cameras and other digital image input devices, see the “Scanners and Digital Cameras” chapter in Part 4 of this guide.

30. NTSC/PAL/SECAM decoder meets PC 99 quality requirements*Consumer PC 99**Office PC 99**Entertainment PC 99**Required**Recommended**Required*

If the system includes an analog video decoder, it must provide proper separation of the luminance and chrominance portions of the signal by employing a 2-D line comb filter or equivalent design. The PC 99 compatibility tests will determine whether there is excessive “cross color,” “hanging dots,” or other artifacts that could spoil the viewer experience. A laser disc player with the Joe Kane Video Essentials disk will be used to assess the video quality.

Video decoders must be capable of decoding full-resolution NTSC/PAL/SECAM signals at 720 samples/line with 8-bit luminance and chrominance sampling.

Support for decoding to 4:2:2 data format is required while support for decoding to the other video formats of 4:2:0, 4:1:1, or 4:4:4 might also be provided as an alternative.

31. Analog video capture device outputs video data rate of 3.7 MB per second, minimum

Required

Recommended: Video capture devices support hardware or software compression for enhanced functionality.

Systems with capture devices must be capable of capturing 3.7 MB per second to disk.

The use of the DV 25 Megabit/sec video compression standard (as used by all digital camcorders) is recommended as a suitable compression scheme for interlaced video that is intended to be edited.

32. Video input or capture device provides raw sampled VBI data

Recommended
Required

This raw VBI data can be decoded in software to provide enhancement data, web pages, and information about elements such as video formats and time code.

Time code is a standard representation of time developed for the video and film industries. Time code is an absolute time format expressed in hours, minutes, seconds, and frames as required by frame-accurate video editing applications. Separate standards are established for NTSC and PAL systems, as follows:

For NTSC-based systems, the defining standard is ANSI/SMPTE 12M. Both drop and non-drop frame formats should be supported.

For PAL-based systems, the defining standard is IEC Publication 461. For film, the defining standard is SMPTE Recommended Practice (RP) 136.

In the future, information from this process may also be passed back to the graphics adapter's driver, if required.

33. Digital video camera uses external bus support

Required

Digital video cameras must provide connectivity using physical wire and driver support to new external buses with isochronous capabilities, particularly USB and IEEE 1394 for high frame-rate devices.

34. Video input image orientation identification meets PC 99 requirements

Required

RGB pixel formats may be described with a BITMAPINFOHEADER that has a negative biHeight value to indicate that the vertical orientation of the image is top-down, but using the sign of biHeight to indicate orientation is only valid for RGB

(uncompressed) formats. The exception is that WDM capture minidrivers are required to only advertise positive biHeight for RGB.

For other compression types, described with a FOURCC code in the biCompression field, the FOURCC code uniquely identifies the compression and orientation. It is not valid to describe the orientation with the sign of biHeight.

Common YUV formats such as UYVY, YV12, and YUY2 are top-down oriented. It is invalid to store an image with these compression types in bottom-up orientation. The sign of biHeight for such formats must always be set positive by drivers producing such formats, and the sign must be ignored by any driver receiving such formats. For proprietary compression formats with an associated FOURCC, any orientation is acceptable, but must always be the same for all bitmaps of that FOURCC.

Analog Television Tuner and VBI Capture Requirements

This section defines requirements for analog television tuner capabilities and VBI data capture capabilities in support of the Windows Broadcast Architecture. This architecture is designed to enable a wide range of data broadcasting services, including the use of decoded data captured from broadcast television signals during the vertical blanking interval (VBI) as well as from video scan lines. All analog tuners must include VBI capture capabilities.

When a tuner and NTSC/PAL/SECAM decoder are implemented as a separate PCI adapter, the uncompressed video data can be fed to the graphics subsystem over a side port such as VIP or over the PCI bus. The latter requires digital video to be bus mastered across to the PCI bus and then fed to the graphics adapter over the AGP bus. This is acceptable, but great care must be taken to ensure that other bus activity is not disrupted. PC 99 compliance testing will include a suite of test programs to determine whether systems are able to meet these requirements.

If the analog tuner and NTSC/PAL/SECAM decoder are in separate places, then analog composite video on coaxial cable can be used to connect the two. Analog switching can be used to allow multiple sources to be routed into the single decoder. The use of a single decoder in the system rather than multiple decoders allows more money to be allocated to doing a good job of decoding. See the “NTSC/PAL/SECAM decoder meets PC 99 quality requirements” item earlier in this chapter.

A tuner card without an NTSC/PAL/SECAM decoder can be used separately for the receiving of data broadcasts. A VBI analog-to-digital converter (ADC) and a bus interface are required to accomplish this implementation. For more information about the operating system Broadcast Architecture and capabilities supported by Windows operating systems, see the Windows NT 5.0 DDK and the white papers available from <http://www.microsoft.com/windows/tv/>.

Cable and broadcast television data networks can inject digital data into any or all video scan lines, including those usually used for images, in the same way that VBI lines can contain data. In general, a VBI decoder refers to the processing of the raw VBI samples into data packets. VBI capture refers to an analog-to-digital converter (ADC) taking VBI samples of VBI data bits. A VBI decoder takes those samples and performs additional processing to determine bit values from the samples. The VBI decoder also handles specific encoding schemes.

VBI decoding can be performed either in hardware or in software. Software VBI decoders need access to oversampled VBI data. In operation, a VBI decoder is similar to a network adapter, except that the data flow is receive-only.

Notice that some requirements in this section specify support related to NABTS data or other locale-specific formats. Devices designed for locales that support other standards do not have to meet these requirements. However, some requirements specify NABTS as an example data format; in these cases, the device must meet the requirements for relevant locale standards.

Important: A PCI-based tuner with its VBI capture and a video decoder device must meet the PC 99 requirements for bus mastering.

35. Analog Television tuner supports PC 99 audio and video performance

Required

The audio and video performance capabilities required for a television tuner are similar to the MP@ML MPEG quality requirements defined in the “MPEG-2 Playback Requirements” section earlier in this chapter, including the following:

- Deliver data at full field rate with smooth delivery and no duplicated fields
- Audio and video playback synchronized to within one and a half video frames.
- Video output quality includes proper de-interlacing (as defined in the “De-interlacing of standard-definition video meets PC 99 requirements” item earlier in this chapter), no tearing, and correct display of multiple aspect ratio content

36. Analog Television tuner includes stereo tuner and supports SAP

Consumer PC 99

Office PC 99

Entertainment PC 99

Recommended

Recommended

RequiredRecommended

It is not an absolute requirement to support stereo audio reception, ie mono reception is acceptable. It is however expected that the market will strongly favor stereo implementations.

This requirement includes support for a secondary audio programming (SAP) channel.

For devices designed for use in Europe and South Africa, the device should support Near-Instantaneously Companded Audio Multiplex (NICAM 728) as the standard for digital multichannel sound transmission.

37. VBI capture oversamples VBI data at least four times*Required*

To ensure accurate data reception, data transmitted on all lines of the VBI must be oversampled at least four times the NABTS data bit rate (or locale-specific data bit rate). For example, if there are 288 bits of NABTS data on a scan line, approximately 1,152 one-byte samples plus the necessary margin (that is, the number required for timing tolerances in the NABTS specification and also for timing uncertainties within the capture hardware) must be captured per scan line.

38. VBI capture makes VBI data available to the CPU for processing*Required*

Raw data samples from VBI lines must go into host memory that can be addressed by the CPU. This data is used to read data encoded into broadcast transmissions, such as closed captioning, V-chip information, NABTS, and Teletext.

Digital Broadcast Television Requirements

The requirements in this section apply for any type of system that implements a digital broadcast subsystem, whether receiving satellite, cable, or terrestrial broadcasts. Such capabilities are recommended but not required for Consumer and Office PC 99 system types and strongly recommended for Entertainment PC 99.

It is recommended that the various different receiver modules for terrestrial, cable, satellite, and so on will be implemented separately from the MPEG video decoder. Separate implementation allows multiple sources of MPEG video to share the use of a single decoder.

It is expected in the PC 99 time frame that receiver modules will be implemented in the following form factors: Device Bay modules, PCI modules, external modules or set-top-boxes using the IEEE 1394 bus, and solutions such as set-top computers. A receiver module that is limited to low bit-rate transmissions (less than 5Mbps) could be implemented using USB. Device Bay is a good solution for receivers requiring conditional access systems, but conditional access systems can also be implemented with any of the other receiver types.

The software running on the host processor should have control of de-multiplexing for all MPEG transport streams. Whether performed in hardware or software, the selection of the required streams and routing of streams to various subsystems should be controlled by software running on the host processor. It may be desirable to filter out unwanted streams to limit the bandwidth needed to get the data into main memory.

The fundamental requirement is that the resulting elementary streams must be routed by the software on the host processor. This will be increasingly essential in the future to support numerous enhanced-functionality implementations such as multiple video windows, video networks, and video resource allocation.

Bandwidth permitting, transport stream de-multiplexing using host software is preferred.

Notice that digital broadcast and satellite support under PC 99 includes all the requirements for hardware decoder capabilities and driver support as defined in this chapter, plus support for the DirectX foundation class, as defined in the Windows NT 5.0 DDK.

Important: The sending of uncompressed high-definition video over the PCI bus is not allowed under the PC 99 guidelines. For situations where the MPEG-2 Main Profile at High Level (MP@HL) decoder is not on the same card as the graphics subsystem, a video port is required to get the uncompressed video data to the graphics subsystem.

39. Digital broadcast module can receive all video, audio, data, and other streams contained in the particular transport stream

Required

This can be a receiver for cable, satellite, or terrestrial digital television broadcasts. The receiver module must provide data tuning, demodulation, conditional access and other network-specific functions.

The receiver card must be able to receive both normal broadcast network-related information, such as MPEG video, audio, and program guide information, as well as data-stream information.

For example, the System Information and Program Guide information available in the MPEG-2 transport system multiplex must be available to applications. If the receiver module is ATSC-compliant, it must make the tables that contain the Program Specific Information Protocol (PSIP) data available. For more information see ATSC T3/S8 Document 193. If DVB-compliant, then the Service Information (SI/PSI) will be made available. For more information, see document ETS 300 available to DVB members at <http://www.dvb.org>.

40. Digital broadcast module can receive full bandwidth from each frequency

Required

The receiver module must be able to receive all information transmitted on any tuner or transponder frequency. For example, if each satellite system transponder has 30 Mb/s of bandwidth, a single-tuner receiver module should be able to transfer all 30 Mb/s of data to the host or de-multiplex the transport stream and route the elementary streams to the host processor. If de-multiplexing is performed on the receiver module, the stream selection and routing must be controlled by software running on the host processor.

41. Digital broadcast module can receive a minimum of eight simultaneous elementary streams*Required*

Recommended: More than fifteen simultaneous elementary streams.

The receiver module must be able to simultaneously receive on the same carrier frequency and send to the host a transport stream with a minimum of eight elementary streams. These streams can be of any type, such as eight simultaneous data streams. These streams, identified by unique service channel IDs (SCIDs) or program IDs (PIDs), are subdivisions of bandwidth on a single tuner frequency.

The receiver module must provide a means for the host processor to control the de-multiplexing of the transport stream (containing the multiple data streams) or pass the complete transport stream to the host processor for software de-multiplexing. The fundamental criterion is that the resulting MPEG elementary streams are routed via the software running on the host processor.

42. System includes multiple digital broadcast tuner modules*Recommended*

Ideally, the PC system can also simultaneously receive two or more broadcast frequencies. The ability to tune to multiple frequencies results in better concurrent data and video operation. With two tuners, the viewer could watch a video on one frequency and download web pages on the other. This also enables picture-in-picture or multiple data streams on different channels or transponders.

Two or more physically separate tuner modules can be used for this, but a better solution is to have a single receiver module capable of receiving multiple channels. This allows the possibility of using one conditional access smart card for multiple channels.

43. Digital broadcast module provides support for conditional access*Recommended*

Receiver modules should support conditional access mechanisms for any subscriptions, pay-per-view events, and other network-specific access-control mechanisms available on the broadcast services for which they are designed. The link from the receiver to player must be a secure link and conform to whatever copy protection scheme that the CPTWG (Content Protection Technical Working Group) adopts.

In many cases, this is a removable smart card that has been paired with code and run on a secure processor on the card. Device Bay provides a convenient way of incorporating a smart card slot, but it is not the only way.

44. Digital broadcast module provides signal quality and other diagnostic information*Required*

The receiver module must be able to self-test and provide diagnostic information such as signal strength, error rate, cable short-circuit events, and the status of any input fuse or circuit breaker. Because these modules are connected to public networks, these capabilities are essential to the carriers who need to diagnose problems in the system.

It should be possible to easily replace a faulty module. Device Bay provides a convenient way of achieving this without having to open the PC's enclosure, but it is not the only way.

It is recommended that systems provide a simple method of aligning satellite dishes and terrestrial antennae. This might include some combination of signal strength, signal-to-noise ratio, and uncorrected Forward Error Correction (FEC) errors.

45. Digital broadcast receiver module supports general-purpose data cryptography*Recommended*

The digital broadcast receiver module must be able to provide both symmetric and asymmetric encryption. If the receiver decrypts the broadcast data, then it must re-encrypt for communication with other devices. Whatever Conditional Access encryption is used must be supported. The asymmetric encryption (such as RSA public Key, or Elliptic Curve public Key) for the exchange of control information and data keys, and a high speed symmetric encryption must be used for data transmission (such as data encryption standard (DES) or Blowfish block cipher). Hardware anti-tampering countermeasures must be implemented. This capability is separate from and completely independent of other digital broadcast capabilities.

All private keys must be stored in protected RAM and ROM, respectively, within the device so that it cannot be easily read using physical means. The manufacturer also must sign the public keys, and the digital signature must be stored within the decryption hardware. Furthermore, there must be a capability for revocation. That is when a key is known to be broken, this information will be broadcast, and devices must be able to recognize whether it is connected to a device with a certification that has been revoked.

The cryptography device need not be directly on the receiver module; it can be a high-speed smart card or PCI device on the system board if it meets the functional specifications.

46. Digital broadcast card supports substream filtering*Recommended*

It is recommended that the digital broadcast receiver card be able to filter out unneeded data substreams (sometimes called subSCIDs or subPIDs) in order to reduce bus activity and CPU usage. Substreams allow data broadcasters to dynamically subdivide their broadcast bandwidth among many data streams of differing size.

Substream filtering lets the host specify which substreams it wants to receive and which should be ignored. This avoids unnecessary bus utilization for data streams that will be discarded by the host software.

47. ATSC DTV tuner is fully implemented*Required*

If an ATSC DTV tuner is implemented, it must meet the requirements for packetized data transport structure, and modulation and transmission system as specified in *ATSC Digital Television Standard (A/53)*, available at <http://atsc.org/>.

48. Stream splitting is supported using DirectShow filters*Recommended*

This function should be provided by DirectShow. Stream splitting is done on the host CPU using DirectShow filters in the same manner as support is implemented for DVD video input data streams.

For current information about the software support planned for this capability, see the related DTV white papers at <http://www.microsoft.com/windows/tv/>.

PC 99 Design for Video and Broadcast Components

This section summarizes requirements related to the PC 99 design initiatives defined in Part 1 of this guide.

Plug and Play and Bus Design for Video and Broadcast Components

The items in this section summarize requirements for Plug and Play and other resource-related and bus-related capabilities.

49. Each device has a Plug and Play device ID*Required*

Each device must have a Plug and Play device ID as required for the bus it uses, as defined in Part 3 of this guide. For example, a PCI device must comply with PCI 2.1 requirements and must provide a Subsystem ID and Subsystem Vendor ID as defined in the “PCI” chapter in Part 3 of this guide.

For video and broadcast hardware, a device can be implemented as a single function device or as part of a multifunction device. All memory and register

resources for this functionality must be distinct and separate from any other functions in the multifunction case.

50. Conflict resolution and dynamic disable capabilities are supported

Required

The operating system must be capable of automatically assigning, disabling, and relocating the resources used by this device when necessary, using the method required for the related bus class. All configuration settings must be capable of being made through software, with no system reboot required.

When the end user changes this device or adds it to the system, setting resource assignments must not require changing jumpers or switches on either the adapter or the system board. In the event of an irreconcilable conflict with other devices on the system, the operating system must be capable of disabling the device to prevent the system from stalling. A disabled device must not claim any resources while disabled.

The exception to this are the VIP bus settings, which might need jumpers to be moved for some sophisticated configurations.

51. Dependent video device is not independently enumerated

Required

If a video device is implemented as a dependent device on a multifunction adapter, it must not be independently enumerated. Instead, its parent must be responsible for installing and loading its driver and for updating the registry on its behalf.

Device Drivers and Installation for Video and Broadcast Components

This section summarizes the PC 99 requirements for video and broadcast components.

52. Device drivers and installation meet PC 99 requirements

Required

The manufacturer does not need to supply a driver for a device if the device passes PC 99 compliance testing using a driver provided with the operating system. If the manufacturer supplies a driver, then the requirements for the device drivers and installation are defined in the “Basic PC 99” chapter in Part 2 of this guide. The basic requirements include driver support for unattended installation and Help file support if special driver parameters are used.

All video components must use a WDM minidriver instead of a VfW driver. For PC 99, a VfW driver is not compliant with these requirements. For information about WDM driver support, see the Windows NT 5.0 DDK. See also the related articles at <http://www.microsoft.com/hwdev/pcfuture/>.

Drivers for hardware decoders and for the audio and video subsystems must be implemented as described in the Windows NT 5.0 DDK in order to support DirectShow, DirectDraw 5.0 VPE, and WDM.

53. Software drivers are installed during hardware driver installation*Required*

Any additional required device-dependent software such as software codecs or NDIS transports must be installed during the device driver installation routine and must be included in the device INF file.

54. Applications provided with device meet Win32 requirements*Required*

Video and image editing applications bundled with the device must support DirectShow.

Any Windows-based applications provided with the device must meet software compatibility requirements as defined by the Win32 SDK. Applications installed with the device must use a standard Windows-based installation method as defined in the Win32 SDK.

55. NDIS 5.0 driver provided for digital broadcast receiver*Required*

IP data carried in a transport stream, either encapsulated in the ~~datagram section~~ MPEG-2 private section format or PES, must be available through the system IP stack using an NDIS miniport driver. The driver for the digital broadcast receiver must be implemented as an NDIS 5.0 driver. The miniport portion of the driver has the extra interface required for network-specific functions such as tuning, access control, program-guide retrieval, and MPEG data retrieval. Drivers for each device must be supplied by the device vendor or network provider.

For information about NDIS 5.0 driver support, see the Windows NT 5.0 DDK.

Video and Broadcast Component References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

Advanced Television Systems Committee (ATSC) standards

National Association of Broadcasters, (800) 368-5644

Society of Motion Picture and Television Engineers, (914) 761-1100

E-mail: mktg@smpte.org

<http://www.atsc.org>

ANSI/SMPTE 12M

SMPTE Recommended Practice (RP) 136 and time-code standards

Society of Motion Picture and Television Engineers

595 West Hartsdale Avenue

White Plains, NY 10607-1824

<http://www.smpte.org/stds/stsubj.html>

DirectDraw VPE and kernel-mode video transport white papers

<http://www.microsoft.com/hwdev/devdes/>

DTV and broadcast architecture white papers
<http://www.microsoft.com/hwdev/pcfuture/bcast1.htm>
<http://www.microsoft.com/windows/tv/>

DVD Specification, Version 1.0, Toshiba Corporation.
<http://www.toshiba.com>

EIA Standard #ANSI/EIA-516-1988: “Joint EIA/CVCC Recommended Practice for Teletext: North American Basic Teletext Specification (NABTS).”
 Electronic Industries Association
 2500 Wilson Boulevard
 Arlington, VA 22201-3834
<http://www.eia.org/>

IEC Publication 461
<http://www.iec.ch/>

Matsushita Electronics Incorporated (MEI) test disc
<http://www.mei.co.jp>

PC Card Standard Guidelines, Volume 10 (PC Card standards)
 PCMCIA
 2635 North First Street, Suite 209
 San Jose, CA 95134 USA
 Phone: (408) 433-2273
 Fax: (408) 433-9558
 E-mail: office@pcmcia.org
<http://www.pc-card.com/>

SFF 8090 (Mt. Fuji specification) and other SFF specifications
 FaxAccess: (408) 741-1600 (fax-back)
 Fax: (408) 867-2115
<ftp://fission.dt.wdc.com/pub/standards/SFF/specs/>

Video Essentials test disc from Joe Kane Productions, Inc.
<http://www.videoessentials.com/>

WDM driver support white papers
<http://www.microsoft.com/hwdev/pcfuture/>

Windows NT DDK, Windows DDK, and DirectX DDK and SDK, including
 NDIS and broadcast services documentation
 MSDN Professional membership

Checklist for Video and Broadcast Components

If a recommended feature is implemented, it must meet the PC 99 requirements for that feature as defined in this document.

Consumer PC 99	Office PC 99	Entertainment PC 99
1. System meets PC 99 requirements for playback of MPEG-2 video from DVD-Video <i>Required with Video</i>	<i>Required with Video</i>	<i>Required</i>

2. System meets PC 99 requirements for playback of MPEG-2 video from digital television broadcasts
Recommended Recommended Required
3. System supports PC 99 analog video input and capture capabilities
Recommended Recommended Required
4. System includes analog television tuner
Recommended Recommended Required
5. System includes digital satellite receiver module
Recommended Recommended Recommended
6. System includes digital cable receiver module
Recommended Recommended Recommended
7. System includes ATSC DTV support
Recommended Recommended Recommended
8. System includes DVB cable, satellite, or terrestrial receiver module
Recommended Recommended Recommended
9. System includes support for multiple digital television delivery methods
Recommended Recommended Recommended
10. MPEG sources such as DVD or a receiver module support bus mastering
Required Required Required
11. Video input, capture, and broadcast device support is based on DirectX foundation class and WDM Stream class
Required Required Required
12. MPEG-2 decoder for high-definition video uses a video port for video data, if implemented in hardware and if separate from the graphics adapter
Required Required Required
13. PCI-based sources of uncompressed standard- definition digital video must support bus mastering with scatter/gather DMA
Required
14. All MPEG-2 decoders can accept an MPEG-2 elementary stream
Required
15. All MPEG transport streams are de-multiplexed by the central host processor
Required
16. Background tasks do not interfere with MPEG-2 playback
Required Recommended Required
17. All components meet PC 99 general device requirements
Required
18. System supports DV decoding and encoding
Recommended Recommended Recommended
19. MPEG-2 MP@ML playback meets PC 99 requirements
Required with Video Required with Video Required
20. MPEG-2 playback for ATSC, DVB, or other digital television systems meets PC 99 requirements
Recommended Recommended Required
21. MPEG-2 video decode implementations meet PC 99 quality requirements
Required Required with Video Required
22. De-interlacing of standard-definition video meets PC 99 requirements
Required with Video Required with Video Required

- 23. Retail adapters with high-definition hardware MPEG-2 decoders on separate card provide a standard video port connection to the graphics adapter
Required
- 24. MPEG-2 decoder supports pull-down algorithm
Recommended
- 25. DVD decoder driver correctly handles media types, time discontinuity, and decode-rate adjustment
Required
- 26. DVD decoder supports subpicture compositing and closed captioning
Required
- 27. Subpicture decoder correctly handles subpicture properties and other functions
Required
- 28. System supports seamless DVD-Video 1.0 navigation
Required
- 29. System provides a licensed CSS copyright protection scheme
Required
- 30. NTSC/PAL/SECAM decoder meets PC 99 quality requirements
Required *Recommended* *Required*
- 31. Analog video capture device outputs video data rate of 3.7 MB per second, minimum
Required
- 32. Video input or capture device provides raw sampled VBI data
Required
- 33. Digital video camera uses external bus support
Required
- 34. Video input image orientation identification meets PC 99 requirements
Required
- 35. Analog Television tuner supports PC 99 audio and video performance
Required
- 36. Analog Television tuner includes stereo tuner and supports SAP
Recommended *Recommended* *Recommended*
- 37. VBI capture oversamples VBI data at least four times
Required
- 38. VBI capture makes VBI data available to the CPU for processing
Required
- 39. Digital broadcast module can receive all video, audio, data, and other streams contained in the particular transport stream
Required
- 40. Digital broadcast module can receive full bandwidth from each frequency
Required
- 41. Digital broadcast module can receive a minimum of eight simultaneous elementary streams
Required
- 42. System includes multiple digital broadcast tuner modules
Recommended
- 43. Digital broadcast module provides support for conditional access
Recommended
- 44. Digital broadcast module provides signal quality and other diagnostic information

Required

45. Digital broadcast receiver module supports general-purpose data cryptography

Recommended

46. Digital broadcast card supports substream filtering

Recommended

47. ATSC DTV tuner is fully implemented

Required

48. Stream splitting is supported using DirectShow filters

Recommended

49. Each device has a Plug and Play device ID

Required

50. Conflict resolution and dynamic disable capabilities are supported

Required

51. Dependent video device is not independently enumerated

Required

52. Device drivers and installation meet PC 99 requirements

Required

53. Software drivers are installed during hardware driver installation

Required

54. Applications provided with device meet Win32 requirements

Required

55. NDIS 5.0 driver provided for digital broadcast receiver

Required